Biocultural diversity : a novel concept to assess human-nature interrelations, nature conservation and stewardship in cities

Elands, B. H. M.

2019-04

Elands , B H M , Vierikko , K , Andersson , E , Fischer , L K , Concalves , P , Haase , D , Kowarik , I , Luz , A C , Niemela , J , Santos-Reis , M & Wiersum , K F 2019 , ' Biocultural diversity : a novel concept to assess human-nature interrelations, nature conservation and stewardship in cities ' , Urban Forestry & Urban Greening , vol. 40 , pp. 29-34 . https://doi.org/10.1016/j.ufug.2018.04.006 , https://doi.org/10.1016/j.ufug.2018.04.006

http://hdl.handle.net/10138/313937
https://doi.org/10.1016/j.ufug.2018.04.006

Title: Biocultural diversity: a novel concept to assess human-nature interrelations, nature conservation and stewardship in cities

Authors: B.H.M. Elands, K. Vierikko, E. Andersson, L.K. Fischer, P. Gonçalves, D. Haase, I. Kowarik, A.C. Luz, J. Niemelä, M. Santos-Reis, K.F. Wiersum

PII: S1618-8667(17)30758-6
DOI: https://doi.org/10.1016/j.ufug.2018.04.006
Reference: UFUG 26118

To appear in:

Received date: 21-12-2017
Revised date: 7-4-2018
Accepted date: 7-4-2018

Please cite this article as: Elands, B.H.M., Vierikko, K., Andersson, E., Fischer, L.K., Gonçalves, P., Haase, D., Kowarik, I., Luz, A.C., Niemelä, J., Santos-Reis, M., Wiersum, K.F., Biocultural diversity: a novel concept to assess human-nature interrelations, nature conservation and stewardship in cities.Urban Forestry and Urban Greening https://doi.org/10.1016/j.ufug.2018.04.006

Biocultural diversity: a novel concept to assess human-nature interrelations, nature conservation and stewardship in cities

Authors

Elands, B.H.M.[1*], Vierikko, K. [2], Andersson, E.[3], Fischer, L.K.[4,5], Gonçalves, P.[6], Haase, D. [7,8], Kowarik, I.[4,5], Luz, A.C.[6], Niemelä, J.[2], Santos-Reis, M.[6], Wiersum, K.F.[1]

Affiliations

[1] Forest and Nature Conservation Policy Group, Wageningen University & Research, P.O. Box 47, 6700 AA Wageningen, the Netherlands. Email: birgit.elands@wur.nl

[2] Strategic research, Research Services, University of Helsinki, Yliopistonkatu 3, P.O. Box 53, 00014 University of Helsinki. Email: kati.vierikko@helsinki.fi,

[3] Stockholm Resilience Centre, Stockholm University, Kräftriket 9A, 106 91 Stockholm, Sweden. Email: erik.andersson@su.se

[4] Department of Ecology, Ecosystem Science/Plant Ecology, Technische Universität Berlin, Rothenburgstr. 12, D-12165 Berlin, Germany. Email: leonie.fischer@tu-berlin.de, kowarik@tu-berlin.de

[5] Berlin-Brandenburg Institute of Advanced Biodiversity Research (BBIB), D-14195 Berlin, Germany

[6] Centre for Ecology, Evolution and Environmental Changes (cE3c), Faculdade de Ciências, Universidade de Lisboa, Campo Grande 1749-016, Lisboa, Portugal. Email: pigoncalves@fc.ul.pt, acluz@fc.ul.pt, mmreis@fc.ul.pt

[7] Humboldt Universität Berlin, Department of Geography, Rudower Chaussee 16, 12489 Berlin, Germany. Email: dagmar.haase@ufz.de

[8] Helmholtz Centre for Environmental Research – UFZ, Department of Urban and Environment Sociology, Permoser Straße 15, 04318 Leipzig, Germany

* Corresponding author

1. Biocultural diversity: an appealing concept

Its origins

The way we think, feel and act regarding nature is fundamentally cultural determined. Throughout history the interaction between societies and nature has resulted in a variety of world views, cosmologies and narratives that reflect relations and relationships among plants, animals and people and the supernatural. This is reflected in the concept of biocultural diversity (BCD), which was developed in the 1990s in order to denote the diversity of life in all its manifestations - biological, cultural and linguistic - which coevolved within complex socio-ecological systems (Maffi, 2005, 2012). It is based on the notion that cultural expressions resonate in a variety of rules, knowledge and practices to maintain venerated natural places and to make sense of and use biodiversity in a culturally informed and informing manner. This is expressed by the Declaration of Belem, that characterizes BCD as "*humankind's accumulated reserve of learned responses to the environment that make co-existence between man and nature and self-recognition possible*" (UNESCO, 1992).

The concept was a response to global concerns regarding the disappearance of tropical forests and other fragile ecosystems, the extinction of many plant and animal species and the disruption of

indigenous cultures around the world. These concerns resulted in the establishment of a global coalition for BCD, which emphasized the historical continuity of the cultures of indigenous people and its relation to their sustainable practices in living with their natural environment (Posey and Dutfield, 1996; Maffi, 2005). It was formalized in 1992 by the UN Convention on Biological Diversity that identified the need to maintain not only biodiversity at the genetic, species and landscape scale, but also the biodiversity-related knowledge, innovations and practices of indigenous people. Since then, many research activities resulted in the growing recognition of BCD as an expression of how cultural practices (e.g. worldviews, storytelling, livelihoods, norms and institutions) reflect and influence relations among plants, animals and people (Posey, 1999; Pretty et al., 2009). It also resulted in gradual shifts in the understanding of the significance of the concept.

From a 'crisis narrative' to a 'dynamic narrative'

The original perspective of studies on BCD emphasized the dual loss of local cultures and wilderness. It was characterized as "*a product of crisis narrative*" (Brosius and Hitchner, 2010:143). This interpretation highlights modernization as the main threat to nature conservation (Pilgrim et al., 2007; Pretty et al., 2009). Several of the original biocultural studies focused on the identification of so-called ecoregional hotspots characterised by a unique combination of biodiversity and linguistic diversity (Loh and Harmon, 2005). While it is true that many indigenous and tribal groups have developed protective regimes towards their natural environment, the idea that they have always acted as nature conservationists has become under dispute (Hames, 2007). Opponents argued that culture is dynamic and that BCD is not inevitably lost with modernization (e.g. Cocks and Wiersum, 2014). The initial interpretation was also criticized for its conservation implications; it became characterised as *"representing nothing less than a new regime of enclosure (….) by establishing a set of comprehensive blueprints for the future of the planet"* (Brosius and Hitchner, 2010, p. 153). Those blueprints gave little input for the dynamics of practices of people living with biodiversity. Consequently, rather than relying only on professional practices that tend to be based on ecosystem thinking, in which living with biodiversity is subordinate or even excluded, there was a call for a more inclusive nature conservation aiming at the stimulation of local-level biocultural practices (Brosius and Hitchner, 2010). In response to cultural dynamics the co-evolution of people and nature may result in new forms of BCD, e.g. in the form of agrobiodiversity (Pretty, 2002; Kareiva et al., 2007). Consequently, the focus of BCD studies gradually shifted from ecoregional hotspots, where indigenous people live in close harmony with their natural surroundings, to cultural landscapes, where biodiversity was modulated over centuries by traditional agricultural practices (White, 2004; Taylor and Lennon, 2011; Pungetti, 2013).

From ecoregional hotspots to urban areas

Although it is true that BCD is critical to indigenous communities that live in natural areas, the original concept of biocultural diversity was also criticized as tending "*to privilege only one part of humanity – those small, diverse indigenous communities living in places of high biodiversity*" and as implying that "*places less diverse are sacrifice zones*" (Brosius and Hitchner, 2010: 143). The recognition of BCD being also a feature of cultural landscapes extended the focus of BCD studies to the modern societies in Europe. In 2014, the Florence declaration on the links between biological and cultural diversity in Europe recognised that *"the current state of biological and cultural diversity in Europe results from a combination of historical and ongoing environmental and land use processes and cultural heritage"* and that *"the predominantly biocultural and multifunctional European landscape assimilates economic, social, cultural and environmental processes in time and space"* (Agnoletti and Rotherham, 2015: 3156).

This acknowledgement resulted in increased attention to the cultural interactions with biodiversity in modern urban areas. These are often overlooked as urban areas have traditionally been conceived of as antipodes of nature. It was therefore considered that, in contrast to people in rural areas, people in urbanised societies live without having close contact to nature. Echoing the 'crisis narrative' some researchers even warn for the 'extinction of experience', arguing that due to the loss of interaction with nature in the form of outdoor activities in nature, ecological knowledge, positive attitudes towards nature protection and pro-environmental behaviour will decline (Soga and Gaston, 2016).

As a result of the acknowledgement of the dynamic nature of the culturally-embedded interactions with biodiversity the views on the extinction of experience have recently been amended. It was gradually recognised that urban green areas can be considered as a cultural landscape embodying a specific type of co-evolution between nature and culture. This is illustrated by the 'four natures-approach', introduced by Kowarik in 1992 (cf. Kowarik 2018), which articulates the variety in human-driven transformations of natural landscapes: (i) remnants of pristine ecosystems, such as forests and wetlands, (ii) patches of ancient agrarian landscapes, (iii) designed urban greenspaces ranging from parks to garden and allotment complexes and recreational areas, and (iv) novel urban ecosystems that arise by chance or as a side-effect of other developments (wastelands, derelict industrial sites, etc.). This diversity in urban landscapes is reflected in a wealth of biodiversity studies that revealed a large variety of either organically evolved or specifically designed assemblages of urban biodiversity and their relevance for biodiversity conservation (e.g. Niemelä, 1999; Barthel et al., 2005; Goddard et al., 2010; Müller and Werner, 2010; Kowarik, 2011; Puppim de Oliveira et al., 2011). Hereby, species may be either pre-adapted, or can adapt genetically or behaviourally, to urban environments (McDonnell and Hahs, 2015). Specific assemblages of urban biodiversity are increasingly culturally appreciated (Millard, 2010). This has resulted in the development of culturally interpreted (novel) wilderness concepts (Wiersum, 2017; Kowarik, 2018; Threlfall and Kendal, 2018) and efforts to stimulate a greener economy (Moreno-Peñaranda, 2013).

In line with this conceptualisation of BCD as relating to dynamic processes, the combatting of the 'extinction of experience' in urban living with biodiversity does not only involve the conservation of historic forms of cultural interaction with biodiversity, but also the development of novel BCD practices. These may not only be developed by professional organisations, but also by non-professional (urban) residents (Groth and Corijn, 2005; Elands et al., 2015). Building on this line of thought of ongoing biocultural dynamics, Elands and Van Koppen (2012:181) introduced the term 'biocultural creatives': "*groups of people who, driven by an engagement with society and nature, create new cultural models and practices for interaction with biodiversity".* In order to understand the diversity of local practices it is important to recognise the different cultural orientations and related knowledge and value frameworks of people, as well as the variation in how they have set up their stewardship arrangements for maintaining BCD. As future societies will largely diverge from today's ones, the cultural perspective and it's dynamics on living with (urban) nature needs careful attention.

Biocultural diversity in cities

As illustrated by the different approaches to studying BCD, the concept is open to different interpretations. The newly evolving perspectives relating BCD to acculturalized urban landscapes formed the starting points for the EU FP7 GREEN SURGE project on linking people and green space in urban environments. The project identified BCD as a key concept for (i) understanding the integration between biological variety in the Urban Green Infrastructure (UGI) and the cultural specificities of the users of UGI, and (ii) developing innovative approaches to planning and governance of UGI (Vierikko et al., 2017a). Considering the prevailing processes of socio-cultural

transitions in European cities the GREEN SURGE approach towards assessing BCD was not only based on its interpretation as an inextricable link between nature and culture, but also as the outcome of not only green urban heritage but also of the ongoing processes of urban transformation. Hence, the GREEN SURGE approach was based on the argumentation that "*If biocultural diversity can be associated with dynamic social processes, then the issue is not only how to preserve or restore culture practices and values, but also how to modify, adapt and create culture in ways that reconnect people with and enhance the diversity of nature."* (after Elands and Van Koppen, 2012: 184). The GREEN SURGE project thus aimed at the further development of theoretical and conceptual thinking of BCD in the urban context.

2. Assessing urban biocultural diversity

The urban green infrastructure (UGI), consisting of e.g. parks, derelict lands, urban gardens, canals and green roofs, is of utmost importance for both the use and well-being of the residents in the embedding cities and the functioning and survival of plants and animals. UGI, as indicated by this definition, is not an ecological network existing independently and in parallel to social life and activities; it is co-constructed by people and ecosystem dynamics in multiple ways: "*By its emphasis on diversity, biocultural diversity can account for the many ways in which people live with green areas in the urban landscape, acknowledges the different knowledges this involves, and can reveal conflicts and ambivalence that may be at stake"* (Buizer et al., 2016: 7). The BCD concept focuses on the interrelationships and interdependencies between people and nature, and, as expressed in terms like 'humans-in-nature', considers humans as agents of ecosystem change (Buizer et al., 2016; Vierikko et al., 2017b). This becomes particularly articulated through the practices by which people develop a relationship with specific places they live, work or recreate in. They are also articulated in the specific constellations of the urban ecosystems that develop in reaction on these practices. Both cultural and utilitarian (productive, regulatory) services of biodiversity feature in the daily practices by which various cultural groups enjoy, understand and protect biodiversity and thus sustain a specific distribution and richness (poverty) of species at place. Human practices are embedded in a complex set of perceptions and values (Botzat et al., 2016). Nature's response is embedded in the complex biophysical human-made and human-influenced setting of an urban ecosystem (Niemelä et al., 2011).

Although in general people value green places positively, different cultural groups can differ in their valuation and understanding of biodiversity—which is, however, largely unexplored (Botzat et al., 2016; but see Fischer et al., 2018a). Some urban green spaces might have unique or universal values in respect to their interaction with nature, but most urban green spaces have multiple values assigned by the different groups of people interacting with specific spaces (Stephenson, 2008). As reflected in the diversity in urban green spaces the presence of such multiple values is especially relevant in urban societies in which a variety of cultural groups with different ethnic background, religion, lifestyles, etc. use and connect with public green (e.g. Kloek et al., 2013). This diversity is steadily increasing and altering by ongoing processes of immigration and trans-cultural exchange. This results in cultural hybridization and increasing heterogeneity of socio-demographic (age, household types, etc.), ethnic, religious and perceptional characteristics of green space users. Such dynamics indicate that culture is neither one-dimensional nor static, but multidimensional and dynamic. Although it is widely acknowledged that the diversity in which cultural groups live with biodiversity in green spaces is a key determinant for the maintenance and adaptation capacity of social-ecological systems (Folke, 2006; Andersson and Barthel, 2016), diversity can also be a source of disputes and conflicts (Vierikko et al., 2017a). The experiences of a particular urban green space by one group might be at the expense of possibilities for 'outsiders' to use it in an alternative culturally

embedded manner or may be at the expense of the integrity (up to the survival) of the ecosystem. This raises justice and equity-questions of 'who benefits' or 'who loses', not only from a social, but also from an ecological perspective (Buizer et al., 2016). Thus, the concept of BCD can highlight both potential opportunities as well as vulnerabilities for the management and conservation of urban green spaces.

Through the interaction with urban green, people develop a bond with it and it becomes a meaningful 'place'. The process of place bonding is dynamic and relational and comes into being as people interact with particular spaces. This interaction might lead to a stronger engagement with urban green in the form of environment stewardship (Mathevet et al., 2017), involving taking responsibility for the sustainable use and conservation of specific biocultural manifestations. Through 'civic ecology practices' (Krasny and Tidball, 2012), citizens create and maintain bioculturally significant places through nature volunteering, urban gardening, public participation in green space development, protesting against development plans in nature areas and the self-governance of urban nature (Buijs et al., 2016; Mattijssen et al., 2018). Such local stewardship is supplemented by the professional landscape designs and the city government's responsibility for maintenance of the entire UGI with its complex of biocultural assemblages (Elands et al., 2015). In doing so, professional managers should be cognizant about the variety of socio-cultural values of different urban groups and how this is related to a variety of local practices in place attachment and place making. They should also recognize that place making by one group may exclude uses and values of other groups and that place-making is inherently political as it involves power differences between groups of people. In dealing with such conflicts and searching for tradeoffs through the creation of new forms of biocultural hybridity, professional managers of UGI must recognise the importance of engagement with different social groups, recognize the diversity in cultural and intangible values and the need to interact with local stakeholders about this diversity and strive for the development of 'commonly accepted frameworks' (Chan et al., 2012).

Thus, in its studies to relate the concept of BCD to the UGI in European cities the GREEN SURGE program took the notion of 'humans-in-nature' (Folke, 2006) as a starting point and acknowledged the variety of cultural values assigned to urban green. It considered that this diversity of values and perceptions is reflected not only in a high diversity in biophysical manifestations of BCD, but also in a variety of practices for the day-to-day use of urban green spaces including the place-making activities of specific (groups of) people (Fischer et al. 2018b). The diversity is also reflected in a variety of biocultural memory carriers, such as artistic objects, oral traditions or monuments (Andersson and Barthel, 2016) and in the diversity in the contents of policy or management plans for urban green (Elands et al., 2015). The cultural expressions and policy statements represent two types of biocultural manifestations: they both express how, as humans, we look at nature from a cultural perspective and how we value it being, at the same time, part of the ecosystem 'city' ourselves.

We developed a conceptual framework for studying the multi-dimensional features of BCD (Vierikko et al., 2017a) (Figure 1). The core idea of the BCD concept is that biodiversity and cultural diversity are inherently connected: for that reason the framework, in contradiction with the social-ecological system framework, does not distinguish between them. The figure depicts three layers: materialized, lived and stewardship, being departure points form which BCD can be studied. Changes in one layer automatically impact the other two layers. The figure illustrates that both established and innovative forms of BCD can exist next to another transversally; moreover, the governance of BCD often integrates past, current and future UGI practices. Each of the layers of this conceptual framework does not only refer to a specific dimension of BCD, but also requires specific methods for BCD assessment.

FIGURE 1 ABOUT HERE

At the heart of framework is ***"lived BCD"*** as this relates to the day-to-day practices of people experiencing green places, encompassing both biological and cultural features. There is a growing recognition of the emergent, co-produced outcome of human-nature interactions. Lived BCD is concerned with the perceived and experienced qualities. These are mediated by our senses and minds, and concern complex systems of values, norms, traditions, knowledge and sensory perceptions. Different scientific approaches and conceptualizations emphasize different aspects and factors to be considered in assessing lived BCD. Under some circumstances knowledge and active cognition may serve as imperative indicators, in other situations relational and embodied perspectives may be more informative. Data collection and analyses are context-sensitive and require attention to qualitative methods of research, e.g. sense of place research, narrative analysis, environmental history and artistic research that are based on qualitative interviews, interpretive reading and observational studies. This qualitative assessment can be complemented by more quantitative methods, e.g. questionnaire surveys, public participation geographical systems (PPGIS), mobile apps for self-reporting, and visitor counts can be used to assess how different groups make use of different bioculturally specific places. Whereas the quantitative methods tend to answer the question what, where, and who, these qualitative methods may focus more on the why and how.

Through lived BCD practices, the world around us is being produced and reproduced. "***Materialized BCD"*** is the tangible articulation of these (re)production processes. Materialized BCD is primarily concerned with the identification and quantification of the biophysical expressions of BCD in the form of different types of spontaneous and domesticated ecological communities and related cultural or technical artefacts of the various components of UGI. The identification of such features is based on the ontological assumption that these discrete objects exist (and are managed) regardless of our perception, and that they can be measured, quantified and monitored. Such tangible BCD lends itself relatively well to large-scale monitoring and cross-case translation and replication, even though the features and indicators that are most relevant in a specific case may vary. Methods for data collection include a combination of (remotely sensed or locally sampled) surveys on different scales of biodiversity, cultural landscapes and biocultural heritage, etc. Data sources and collection methods include census data, surveys, inventories and historical records. While arguably objects can be said to have individual, independent identities, they also include additional levels of meaning that we attach to them, which is something more akin to and expressly addressed under "lived BCD".

While lived BCD in some ways can be said to be more passive and primarily mediated through perceptions on the culturally-embedded relevance of different assemblages of biodiversity, "***stewardship of BCD"*** is an active, conscious engagement in the shaping of such assemblages. This engagement reflects a bonding. From a scientific point of view, the analysis of stewardship of BCD overlaps with the analysis of lived BCD in its interest in motivations, values, actions, norms, etc. In addition, it highlights knowledge in its different forms and how knowledge informs and influences the motivations to actively maintain the esteemed BCD or to further develop it in a process of co-production. Moreover, it emphasizes the bonding with nature that arises from it, and as such it is the ultimate consequence of the 'humans-in-nature' principle (see also Vierikko et al., 2017b). Assessing stewardship needs attention to both individuals and to group processes, and shares the qualitative—quantitative duality of the assessment of lived BCD. Scientific themes of relevance include social movements and social organization, local ecological knowledge, environmental psychology, etc. The methods for data collection include interviews, document analysis, observational studies, (observational) surveys and cognitive studies.

In this framework, BCD is not conceived of as a definite concept providing prescriptions of what to see (e.g. threatened biocultural heritage in need of conservation) but as a reflexive and sensitising concept that can be used to assess different values and knowledge of people that reflect how they live with biodiversity in cities (Turnhout et al., 2013; Buizer et al., 2016). It recognizes urban biocultural diversity as embracing both heritage values and expressions of newly evolving forms of living with biodiversity. It also recognizes the diversity in professional and laymen's practices in actively engaging with biodiversity in a variety of stewardship systems. Thus, it calls attention to the diversity in ontological and epistemological interpretations of the concept of biocultural diversity and the moral and political implications in developing increased awareness of the multiple expressions of urban biocultural diversity as both a heritage-based and a dynamic phenomenon.

3. Implications for UGI-policy makers, planners, managers

Formal governance has several important roles in cultivating and supporting BCD. First, it is deeply involved in the stewardship aspect of BCD through professional planning, design and maintenance of UGI. Second, it creates or shapes many of the conditions that set the boundaries for BCD. Given the anchoring of BCD in formal governance and considering the GREEN SURGE notion of BCD as a reflexive concept that pays tribute to the diversity in contextual situations in respect of how people live with and act as stewards for biodiversity, we provide the following recommendations for policy makers and professional planners and managers:

- Use BCD as a tool not only to preserve, restore or stimulate cultural practices and values that support biodiversity, but also to recognize and make space for the inherent socio-cultural diversity in people's living with biodiversity and in actively engaging with its stewardship. In doing so, attention must be given to the compatibility and conflicts between the various manifestations of BCD, the related value-embedded practices, and to their dynamic nature.
- Engage with biodiversity as something more than (threatened) species and ecosystems and explicitly include the human domain, e.g. by involving heritage species or urban green that reflects our long history of co-evolution of living with different ecological communities.
- Use BCD dynamically, going beyond manifestations of historic urban landscapes reflecting urban heritage to include also ongoing processes of cultural dynamics and urban transitions.
- Be aware of the multiple contributors to BCD dynamics and the broad range of opportunities these create for making biodiversity and green spaces more meaningful to people. Urban green spaces, like other cultural landscapes, have multiple layers of place identity. The cultural interactions with biodiversity in such multi-identity landscapes is informed by shifting artistic trends and values, ongoing storytelling and other processes of actively making sense of the space specific groups of urban people live in.
- Recognize diversity and dynamics within cultural values and their reciprocal connections to diverse ways of living with and relating to urban biodiversity, and of place-specific stewardship arrangements. This diversity offers a rich source of inspiration for how to maintain and how to further stimulate the preservation and development of bioculturally significant urban spaces. However, note that it may also lead to conflicts between different socio-cultural groups and perspectives over the desired nature of specific urban spaces.
- Base policy, planning and management of urban green spaces on an inclusive approach that does not only consider threats to BCD, but that also acknowledges the diversity in place-specific expressions of living with biodiversity and in stewardship arrangements for maintaining BCD as well as in creating new types of biocultural manifestations in response to urban dynamics.
- Be aware that BCD living and stewardship practices are highly diverse; they may not only differ between different cultural groups, but also between professionals and lay people. As such, BCD is not 'neutral', but a concept that recognizes the political nature of UGI planning and management.

These recommendations can be translated into effective practice through governance approaches such as biocultural design (Davidson-Hunt et al., 2012), biocultural creativity (Elands and Van Koppen, 2012) and mosaic governance (Buijs et al., 2017, Buijs et al., this issue). These approaches

aim to stimulate endogenous innovation within local communities and to promote diversity in active citizenship practices. Thus, the notion of BCD offers to transcend and move us beyond 'crisis narrative' of urban areas as man-made biotopes almost devoid of nature. Instead, it offers a 'dynamic narrative' that acknowledges the diversity and dynamics in co-evolutionary interactions between people and nature in urban areas and the hybridity in the multiple manifestations of urban BCD.

Acknowledgements

This research was supported by the European Commission, 7th Framework Programme Grant GREEN SURGE collaborative project, FP7-ENV.2013.6.2-5-603567.

References

Agnoletti, M., Rotherham, I.D., 2015. Landscape and biocultural diversity. Biodiversity and Conservation 24(3), 3155-3165.

Andersson, E., Barthel, S., 2016. Memory carriers and stewardship of metropolitan landscapes. Ecological Indicators 70, 606-614.

Barthel, S., Colding, J., Elmqvist, T., Folke, C., 2005. History and local management of a biodiverse-rich, urban cultural landscape. Ecology and Society 10(2), 10.

Botzat, A., Fischer, L.K., Kowarik, I., 2016. Unexploited opportunities in understanding liveable and biodiverse cities. A review on urban biodiversity and valuation. Global Environmental Change 39, 220-233.

Brosius, J.P., Hitchner, S.L., 2010. Cultural diversity and conservation. International Social Science Journal 199, 141-168.

Buijs, A.E., Mattijssen, T.J.M., Van der Jagt, A.P.N., Ambrose-Oji, B., Andersson, E., Elands, B.H.M., Steen Møller, M., 2016. Active citizenship for urban green infrastructure: fostering the diversity and dynamics of citizen contributions through mosaic governance. Current Opinion in Environmental Sustainability 22, 1-6.

Buijs, A.E., Elands, B.H.M., Havik, G., Ambrose-Oji, B., Gerőházi, E., Van der Jagt, A.P.N., Mattijssen, T.J.M., Steen Møller, M., Vierikko, K., 2016. Innovative Governance of Urban Green Spaces: Learning from 18 innovative examples across Europe. GREEN SURGE Deliverable 6.2. http://greensurge.eu/working-packages/wp6/files/Innovative_Governance_of_Urban_Green_Spaces_-_Deliverable_6.2.pdf

Buijs et al this issue

Buizer, M., Elands, B., Vierikko, K., 2016. Governing cities reflexively—The biocultural diversity concept as an alternative to ecosystem services. Environmental Science & Policy 62, 7-13.

Chan, K.M.A., Guerry, A.D., Balvanera, P., Klain, S., Satterfield, T., Basurto, X., Bostrom, A., Chuenpagdee, R., Gould, R., Halpern, B.S., Hannahs, N., Levine, J., Norton, B., Ruckelshaus, M., Russell, R., Tam, J., Woodside, U., 2012. Where are Cultural and Social in ecosystem services? A framework for constructive engagement. Bioscience 62, 744–756.

Cocks, M.L., Wiersum, F., 2014. Reappraising the concept of biocultural diversity: a perspective from South Africa. Human Ecology 42, 727-737.

Davidson-Hunt, I.J., Turner, K.L., Te Pareake Mead, A., Cabrera-Lopez, J., Bolton, R., Idrobo, C.J., Miretski, I., Morrison, A., Robson. J.P., 2012. Biocultural Design: A New Conceptual Framework for Sustainable Development in Rural Indigenous and Local Communities. Sapiens 5.2.

Elands, B.H.M., Van Koppen, C.S.A., 2012. Biocultural diversity in the Netherlands: from ecologically noble savages towards biocultural creatives. In: Arts, B.J.M., Van Bommel, S., Ros-Tonen, M.A.F., Verschoor, G.M. (Eds.), Forest-people interfaces; understanding community forestry and biocultural diversity. Wageningen Academic Publishers, Wageningen, pp. 181-193.

Elands, B.H.M., Wiersum, K.F., Buijs, A.E., Vierikko, K., 2015. Policy interpretations and manifestation of biocultural diversity in urbanized Europe: conservation of lived biodiversity. Biodiversity and Conservation 24, 3347-3366.

Fischer, L.K., Honold, J., Cvejić, R., Delshammar, T., Hilbert, S., Lafortezza, R., Nastran, M., Nielsen, A.B., Pintar, M., van der Jagt, A., Kowarik, I., 2018a. Beyond green: broad support for biodiversity in multicultural European cities. Global Environmental Change 49, 35-45.

Fischer, L.K., Honold, J., Botzat, A., Brinkmeyer, D., Cvejić, R., Delshammar, T., Elands, B., Haase, D., Kabisch, N., Karle, S.J., Lafortezza, R., Nastran, M., Nielsen, A.B., van der Jagt, A.P., Vierikko, K., Kowarik, I., 2018b. Recreational ecosystem services in European cities: sociocultural and geographic context matters for park use. Ecosystem Services, DOI: https://doi.org/10.1016/j.ecoser.2018.01.015.

Folke, C., 2006. Resilience: the emergence of a perspective for social-ecological systems analyses. Global Environmental Change 16, 253–267.

Goddard, M.A., Dougill, A.J., Benton, T.G., 2010. Scaling up from gardens: biodiversity conservation in urban environments. Trends in Ecology & Evolution 25, 90-98.

Groth, J., Corijn, E., 2005. Reclaiming urbanity: indeterminate spaces, informed actors and urban agenda setting. Urban Studies 42, 503-526.

Kareiva, P., Watts, S., McDonalds, R., Boucher, T., 2007. Domesticated nature: Shaping landscapes and ecosystems for human welfare. Science 316, 1866–1869.

Kloek, M.E., Buijs, A.E., Boersema, J.J., Schouten, M.G.C., 2013. Crossing borders: review of concepts and approaches in research on green space, immigration and society in Northwest European countries. Landscape research 38, 117-140.

Kowarik, I., 2011. Novel urban ecosystems, biodiversity, and conservation. Environmental Pollution 159, 1974-1983.

Kowarik, I., 2018. Urban wilderness: supply, demand, and access. Urban Forestry & Urban Greening 29, 336-347.

Krasny, M.E., Tidball., K.G., 2012. Civic ecology: a pathway for Earth Stewardship in cities. Frontiers in Ecology and the Environment 10, 267-273.

Loh, J., Harmon, D., 2005. A global index of biocultural diversity. Ecological Indicators 5, 231–241.

McDonnell, M.J., Hahs, A.K., 2015. Adaptation and adaptedness of organisms to urban environments. Annual Review of Ecology, Evolution, and Systematics 46, 261–280.

Maffi, L. 2005. Linguistic, cultural and biological diversity. Annual Review of Anthropology 34, 599-617.

Maffi, L. 2012. Biocultural diversity conservation. Earthscan, UK, p. 5.

Mathevet, R., Bousquet, F., Raymond, C.M., 2017. The concept of stewardship in sustainability science and conservation. Biological Conservation 217, 363-370.

Mattijssen, T., Buijs, A., Elands, B., Arts, B. (2018) The 'green' and 'self' in green self-governance - a study of 264 green citizen initiatives. Journal of Environmental Policy & Planning 20, 96-113.

Millard, A., 2010. Cultural aspects of urban biodiversity. In: Müller, N., Werner, P., Kelcey, J.G. (Eds.), Urban biodiversity and design. Wiley-Blackwell, UK, pp. 56-80.

Moreno-Peñaranda, R., 2013. Biodiversity and culture, two ingredients for a truly green urban economy: learning from agriculture and forestry practices in Kanazawa city, Japan. In: Simpson, R., Zimmermann, M. (Eds.), The economy of green cities: a world compendium on the green urban economy. Springer, Dordrecht (NL), pp. 337-349.

Müller, N., Werner, P., 2010. Urban Biodiversity and the Case for Implementing the Convention on Biological Diversity in Towns and Cities. In: Müller, N., Werner, P., Kelcey, J.G. (Eds.), Urban Biodiversity and Design. Wiley-Blackwell, UK, pp. 3-34.

Niemelä, J., 1999. Is there a need for a theory of urban ecology? Urban Ecosystems 3, 57-65.

Niemelä, J., 2011. Introduction. In: Niemelä, J, Breuste, J.H., Guntenspergen, G., McIntyre, N.E., Elmqvist, T., James, P. (Eds.), Urban ecology; patterns, processes and applications. Oxford University Press, Oxford.

Pilgrim, S.E., Cullen, L.C., Smith, D.J., Pretty, J., 2007. Ecological knowledge is lost in wealthier communities and countries. Environmental Science & Technology 42, 1004-1009.

Posey, D.A., Dutfield, G., 1996. Beyond Intellectual Property: Traditional Resource Rights for Indigenous Peoples and Local Communities. Ottawa, Canada, International Development Research Centre.

Posey, D.A., 1999. Cultural and spiritual values of biodiversity. A complementary contribution to the global biodiversity assessment. United Nations Environment Programme.

Pretty, J., 2002. Agri-culture. Reconnecting people, land and nature. Earthscan Publications, London.

Pretty, J., Adams, B., Berkes, F. F., de Athayde, S., Dudley, N., Hunn, E., Maffi, L., et al., 2009. The intersections of biological diversity and cultural diversity: Towards integration. Conservation and Society 9, 100–112.

Pungetti G., 2013. Biocultural Diversity for Sustainable Ecological, Cultural and Sacred Landscapes: The Biocultural Landscape Approach. In: Fu B., Jones K. (Eds.), Landscape Ecology for Sustainable Environment and Culture. Springer, Dordrecht, pp. 55-76.

Puppim de Oliveira, J.A., Balaban, O., Doll, C.N.H., Moreno-Peñaranda, R., Gasparatas, A., Iossifova, D., Suwa, A., 2011. Cities and biodiversity: perspectives and governance challenges for implementing the convention on biological diversity (CBD) at city level. Biological Conservation 144, 1302-1313.

Soga, M., Gaston, K.J., 2016. Extinction of experience: the loss of human-nature interactions. Frontiers in Ecology and the Environment 14, 94-101.

Stephenson, J., 2008. The Cultural Values Model: An integrated approach to values in landscapes. Landscape and Urban Planning 84, 127–139.

Taylor, K., Lennon, J., 2011. Cultural landscapes: a bridge between culture and nature? International Journal of Heritage Studies 17, 537-554.

Threlfall, C.G., Kendal, D., 2018. The distinct ecological and social roles that wild spaces play in urban ecosystems. Urban Forestry & Urban Greening 29, 348-356.

Turnhout, E., Waterton, C., Neves, K., Buizer, M. 2013. Rethinking biodiversity: from goods and services to 'living with'. Conservation Letters 6, 154–161.

UNESCO, 1992. Declaration of Belem. Third UNESCO Science and Culture Forum. Towards eco-ethics: alternative visions of culture, science, technology and nature. Belem, Para, Brazil, 6-10 april 1992

Vierikko, K., Andersson, E., Branquinho, C., Elands, B., Fischer, L.K., Gonçalves, P., Grilo, F., Haase, D., Ioja, C., Kowarik, I., Lindgren, J., Mendes, R., Niemelä, J., Pieniniemi, M., Príncipe, A., Puttonen, M., Santos-Reis, M., Teixeira, D., Vieira, J., Yli-Pelkonen, V., 2017a. Identifying, Quantifying and Qualifying Biocultural Diversity. Assessment of biocultural diversity. GREEN SURGE Deliverable D2.3.

Vierikko, K., Elands, B.H.M., Niemela, J., Andersson, E., Buijs, A.E., Fischer, L.K., Haase, D., Kowarik, I., Kabisch, N., Luz, A.C., Stahl Olafsson, A., Száraz, L., Van der Jagt, A., Konijnendijk van den Bosch, C., 2017b. Considering the ways biocultural diversity helps enforce the urban green infrastructure in times of urban transformation. Current Opinion in Environmental Sustainability 22, 7-12.

White, R. 2004. From wilderness to hybrid landscapes: the cultural turn in environmental history. The Historian 66, 557-564.

Wiersum, K.F. 2017. New interest in wild forest products in Europe as an expression of biocultural dynamics. Human Ecology 45:787–794.

Figure Caption

Figr-1

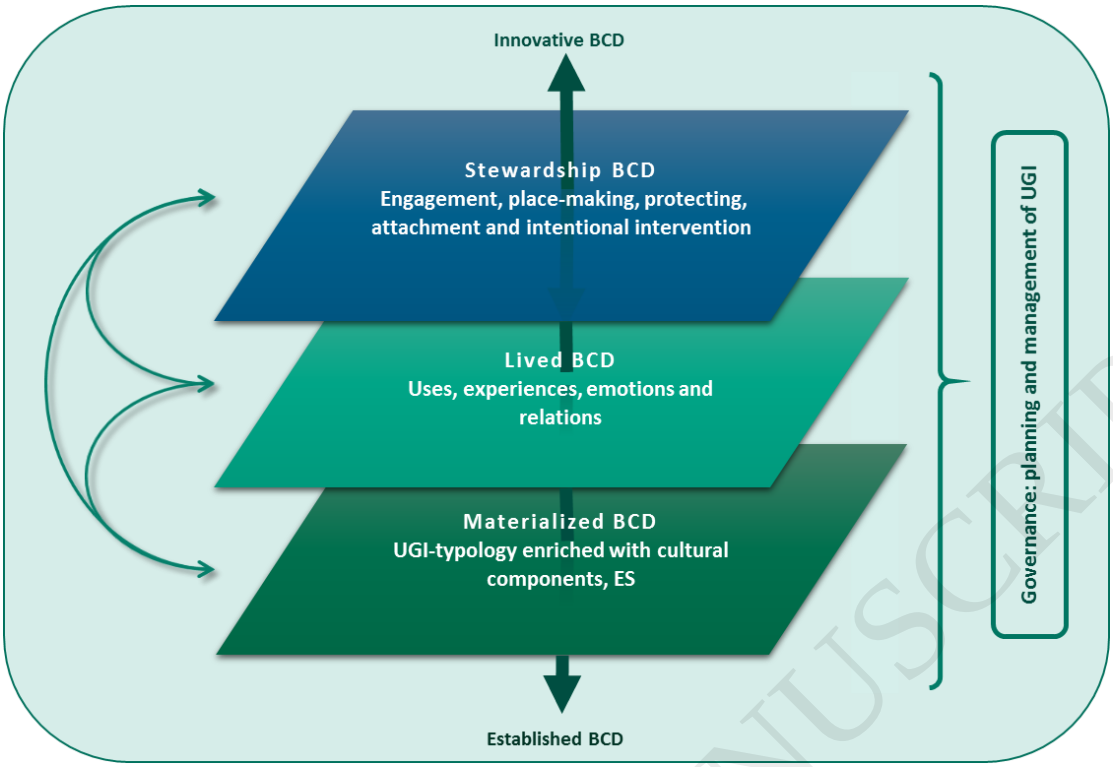

Figure 1. Conceptual framework for the study on and governance of biocultural diversity in cities.